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Hog Operations Becoming Larger, More Specialized

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PERSPECTIVES

Total U.S. farm debt at the end of 1990, excluding household debt, was estimated at $133.9 billion. This was 1.3 percent lower than a year earlier and 31 percent below the 1983 peak of nearly $193 billion.

The greatest decrease in farm debt volume in 1990 was in the Farmers Home Administration (FmHA). Smaller declines were reported in the amount of debt held by life insurance companies and individuals. The Farm Credit System (FCS) and commercial banks registered increases in loan volume.

Farm banks, unlike large urban commercial banks, had a good year in 1990, continuing their recovery from the hard times of the mid-1980's, according to economist Jerry Stam of USDA's Economic Research Service. Farm banks registered their highest rates of return on assets (1.04 percent) and equity (11.4 percent) since 1983. (For additional analysis of the performance of rural banks, see the story on page 12.)

The capital ratios of farm banks, at 10.2 percent of assets, indicate substantial ability to survive any short-term farm financial downturn. Farm banks' loan-to-deposit ratios were down slightly at midyear 1990 to 55.3 percent, below historical levels and below the levels desired by management, Stam says.

Farm banks as a group are now among the healthiest of commercial banks, according to the economist. He adds that the few farm bank failures in 1990 demonstrated a continued dwindling of problem banks.

As of mid-1990, the FCS and life insurance companies had experienced slight increases in the delinquent portion of loan portfolios, banks were unchanged from their yearend 1989 level, and FmHA reported a decline. Loan chargeoffs were down for farm banks.

Farmers remain cautious about taking on new debt, Stam says. He adds that stable land values and strong farm income could generate a slight increase in farm debt this year. Lending capacity is more than adequate to handle the demand, particularly at commercial banks, ERS analysts believe.

Farm interest rates declined in 1990 and analysts are expecting further declines this year, possibly one-half to three-fourths of a percentage point. Interest rates on nonreal estate farm loans in 1990 averaged 11.50 percent for commercial banks and 11.16 percent for the FCS. The averages for real estate loans were 11.71 percent at commercial banks and 10.56 percent for the FCS.

Some FCS institutions remain in a weak financial condition. The St. Paul, Louisville, Omaha, and Spokane Farm Credit Banks have received assistance under the Farm Credit Act of 1987. Of the $4 billion line of credit authorized by the act, $1.26 billion has been utilized. The last of the Jackson Federal Land Bank receivership assets and liabilities were disposed of during 1990.

The startup of Farmer Mac (the Federal Agricultural Mortgage Corporation), the new secondary market for farm mortgages that was created by the 1987 law, has been slowed by several factors. Stam says these include regulatory capital requirements for banks, the difficulty of standardizing loans because of the diversity of the farm sector, the challenge of structuring price-competitive securities, and low loan-to-deposit ratios at commercial banks.

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AGRICULTURE...NATURAL RESOURCES...RURAL DEVELOPMENT
Practical economic intelligence from USDA's Economic Research Service

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Concentration in the U.S. hog industry is continuing, driven by economies of size. The number of hog operations declined by nearly 300,000 between 1980 and 1987, a decrease of almost 50 percent. More efficiency in production might even lead to an increase in per capita consumption of pork.

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After struggling through difficult times in the mid-1980's, rural financial institutions are now doing much better. Credit standards have been tightened and ample credit is available for qualified borrowers.

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Hog Operations Becoming Larger, More Specialized

Spurred by higher profits from heftier operations, American hog producers are becoming both bigger and more specialized than ever before.

In fact, fewer than 100,000 operations now account for about 94 percent of the hog inventory, and fewer than 11,000 operations account for 42 percent.

In less than 40 years, the industry has been transformed by increasing size and greater specialization.

In 1954, for example, there were 2.4 million hog producers in the United States. Fully a fourth of them had only four hogs per farm (accounting for 4 percent of all hogs), while the largest 20 percent of producers averaged 66 hogs per farm and produced over 56 percent of the nation's hogs. Overall, the average number of hogs per operation in 1954 was 24.

By 1964, says economist Felix Spinelli of USDA's Economic Research Service, "producers selling 1,000 hogs or more a year provided 7 percent of total production. But by 1979, producers at this sales level accounted for 40 percent of total production."

Seven Midwestern States produce two-thirds of U.S. hogs.

This trend continued as hog producer numbers declined by almost half between 1980 and 1987—from 640,000 to 346,890—with further production specialization. And concentration in the industry continues to be pushed by economies of size.

Past studies have shown where these economies of size can be found. Spinelli says the types of production efficiencies that can be used for economies of size fall into eight categories: pounds of hogs produced per litter, pigs farrowed and weaned per litter, litters produced and pigs weaned per female per year, death loss, weight of hogs sold, and pounds of concentrate feeds fed per hundredweight of production.

"On farrow-to-finish operations, improved feed conversion rates, lower feed prices, and lower fixed cash costs are found on larger production units compared with their smaller-sized counterparts," says Spinelli. "The largest farrow-to-finish units generally had $15 to $20 lower total costs per hundredweight of sales, on a long-term basis, than did the smallest ones."

Large feeder pig production units gained economies from better feed efficiencies, cut feed costs through volume purchases, and used other cash inputs more effectively than small producers, following the pattern of farrow-to-finish operations. Economies of size within this farm type resulted in a cost difference of between $25-$45 per $100 of gross income.

"Larger hog finishers realize economies from increased production efficiencies and output price advantages, mainly from year-round marketings compared to seasonal marketings for smaller producers," says Spinelli. "Cash costs make up about four-fifths of all costs, excluding the feeder pig cost, of finishing pigs. Thus, feeding efficiencies have more impact on finishing operations than on feeder pig production and farrow-to-finish operations."

Cost differences here ranged from $10-$15 per $100 of sales between large and small finishing operations. And economies of size extend to the packing plant, especially at the largest capacities.

"Although there were more than 1,100 plants slaughtering hogs in the United States in 1989," Spinelli says, "33 plants accounted for 76 percent of the total U.S. hog slaughter. Twenty-four of these plants each slaughtered more than 1.5 million hogs per year."

These changes have occurred in the face of relatively flat per capita pork consumption, measured on a boneless equivalent basis.

"The annual growth rate in total consumption was about the same as the rate of

Pigs Credited With an Important Place in History

Hogs and pigs are unquestionably a vital part of the American agricultural sector—but have they also been a boon to the growth of Western civilization and the building of America's heartland?

Yes, according to a number of agriculturalists who have examined the pig's place in history.

"Some authors suggest the pig aided in the advancement of civilization," says ERS economist Felix Spinelli, who notes that "hogs are credited with clearing land on the outskirts of towns in Europe and with providing increased incentive to bring Great Plains land into corn production to feed increased hog numbers in the 1800's."

Early on, Spinelli says, farmers found pigs to be handy to have around.

"Flexibility to survive on a varied diet has made the keeping of swine attractive to farmers," he says. "Other positive characteristics include the domestic pig's ability to produce large numbers of offspring, the pig's ability to grow fast, its early value as a source of lard for cooking and soap, and its value as a source of meat."

The domestic pig is able to obtain most of its nutritional needs almost entirely from either animal-based feedstuffs or feed concentrates from plant origin.

"This ability is due to the increased length of the domestic pigs' large intestines," says Spinelli. "A cat's intestines are 4 times its body length; a wild boar, 9 times its body length; and the domestic pig, 14 times its body length. And the longer food is being digested, the more nutrients can be absorbed."

The general production characteristics of the hog—its ability to eat a varied diet, to grow and multiply rapidly, and to be raised in confined quarters—are results of its evolutionary past.

"Much like many animals of the wild which bear young in the spring, the life cycle of the domestic pig back 100-200 years ago revolved around one farrowing in the spring, growth and development in the summer, a fattening period during harvest, and fall-winter slaughter and processing," says Spinelli.

In fact, the slaughter and packing season was limited to the colder months of the year because artificial refrigeration was not available until the 1870's. The invention of refrigeration machinery and of the refrigerated railcar made pork production independent of season—as far as slaughtering and processing were concerned.

The hog enterprise provided an effective and economic way to dispose of surplus grain or grain damaged by frost, drought, rust, rain, or storage while serving as the principal source of red meat for human use. In these early times, one could trace the origins of all the heavy pork producing countries in the world to at least one of pork's attributes.

"For example, hog production was fostered in the world's three corn belts (the U.S. Corn Belt, the LaPlata region of South America, and the Danube basin of southeastern Europe) because of the availability of cheap feed grains," Spinelli says.

Other examples are:

— Scandinavian countries and Canada where the leaner bacon-type hog could convert small grains and dairy by-products.

— Germany and Poland where pork, lard, and potatoes were dietary mainstays.

— China and many Latin American countries where hogs could be fattened on refuse from the kitchen, garden, and field, and slaughtered for home consumption.

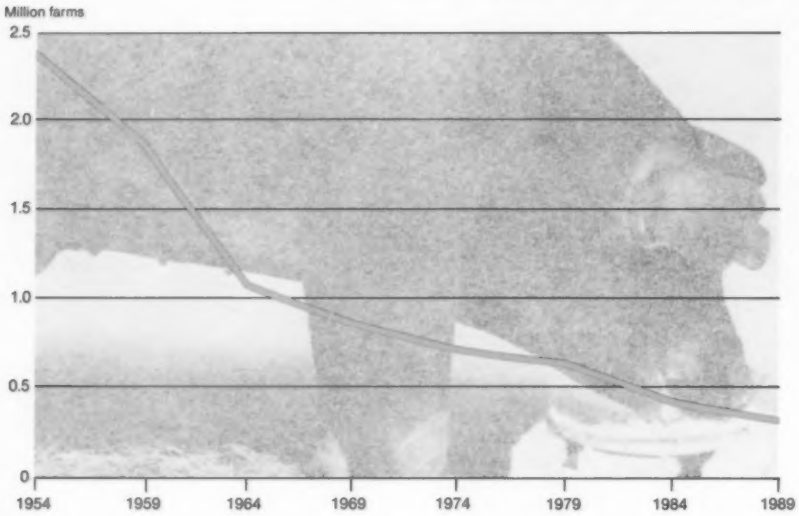
"A combination of these reasons—plus the swine operation's effective mix with other activities on diversified farms and the superior storability of pork over other meats—made pork the most important meat staple in North America until the 1920's," says Spinelli. "It was also a major export commodity with over a billion pounds (half of which was lard) exported annually until the 1930's."

"By the 1950's, as a consequence of more and more people leaving the farm to work in town, per capita pork consumption stayed fairly constant while beef production and consumption grew with rising per capita nonfarm incomes," he says, "allowing beef to surpass pork in importance as a livestock product and as a meat source."

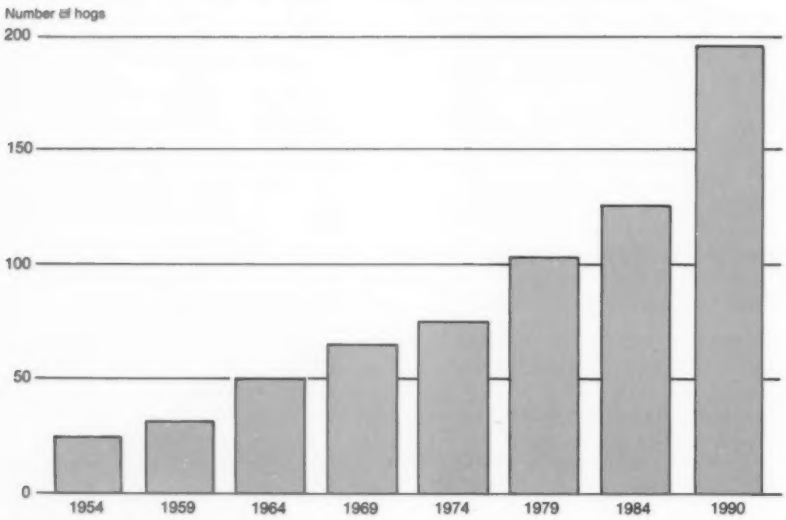
By 1984, U.S. poultry (chicken and turkey) consumption had also surpassed pork in per capita consumption.

Even so, pork manages to do more than merely survive. Today's pork finds itself on U.S. consumers' tables in a variety of products—many of them with less fat content than some poultry products. And such leaner products, say pork industry officials, help the industry as it campaigns to popularize pork as "the other white meat."

The Number of U.S. Hog Farms Decreased by 85 Percent in a 35-Year Period . . .



. . . And the Number of Hogs per Farm Increased Proportionally



Source: USDA, National Agricultural Statistics Service.

population growth," says Spinelli. "That translates to about a 46-percent increase in boneless equivalent consumption from 1955 to 1989."

The stagnant per capita consumption pattern for pork over time has been attributed partly to pork's "blue-collar" image among consumers.

"With total meat demand increasing," says Spinelli, "pork consumption as a percentage of total red meat and poultry consumption actually lost over 10 percent of its share, even though total pork production increased over the years. Thus, although consumers have not actually shifted away from pork on a per capita basis, they have increased their beef consumption (until 1976) and poultry consumption."

Higher Pork Consumption?

Hog producers, however, are hopeful that Americans will eat more pork products. And those hopes rest with what is already happening in the industry—concentration.

"Large hog producing units—which raise, process, and market pork—appear to be in a position to dominate production in the future in light of the apparent economies of size," says Spinelli. "As these operations come on line, their production could become more stable across seasonal periods than smaller producers'. In the process, pork production may become more cost competitive with the highly integrated poultry industry and possibly make some inroads in increasing per capita pork consumption levels."

One major aspect of hog production, though, hasn't substantially changed.

"U.S. production of hogs occurs predominantly in the Corn Belt, in and around major corn and soybean producing areas," he says.

Feed (corn and soybean meal) is the most costly production input. It makes up about half the total cost for feeder pig producers, about 60 percent for a farrow-to-finish operator, and about two-thirds the total cost for a feeder pig finisher.

"Seven Midwestern States accounted for 66.5 percent of hog production in 1987, while at the same time producing 62.5 percent of the nation's corn," says Spinelli.

But there is more to regional competitiveness or profitability in hog production than feed availability, namely, the factor of feed conversion efficiency.

"Technical data and research in the 1960's indicated that feed efficiency in hog production is optimal between 55 degrees and 65 degrees Fahrenheit, with efficiency decreasing rapidly with both lower and higher temperatures," says Spinelli. "This research has showed that the North Central region held an annual average advantage in lower unit costs of hog production, in this regard, over locations in the Southeastern United States. But, now that many hogs are produced in environmentally modified buildings, this may not be the case."

Despite the continuing dominance of operations in the Corn Belt, a typical hog farm there—as in other parts of the United States—is far different today than it was in the 1950's.

"Up until the 1950's in the United States," says Spinelli, "swine production on most farms was only one component in a multi-enterprise operation. The hog enterprise was simply supplemental to other enterprises, especially crop production, on most farms. It mainly provided meat to the family and another way to market corn in times of excess production."

Moreover, the one-season swine operation of many years ago (with farrowings only in mid-summer after final cultivation of row crops) allowed farmers to work the hog operation around the harsh weather of winter and the demand for labor from competing farm tasks (especially spring cropping chores and fall harvesting commitments).

"Still depending on one sow herd group, some operations became 2-season ones with one farrowing after the weather moderated in spring, but before starting field work (generally in March), and another farrowing before the fall harvest," says Spinelli. "These farmers saw the advantages of the two litter system as allowing greater utilization of resources, enjoying more favorable prices in spring marketings, and spreading production price risks—by reducing the disease possibilities across farrowings and spreading marketings across the year."

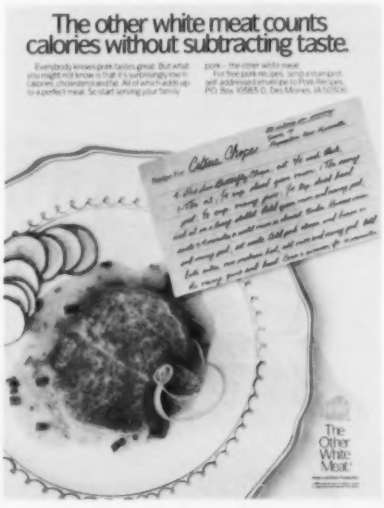
Scientific Advances

Little had changed to alter these basic production patterns until the advent of climate-modified confinement housing and advances in genetics, medicines, and management.

"The 1960's saw greater and greater percentages of pigs being raised in confinement housing," says Spinelli. "Hog production became the dominant enterprise on many farms, and scheduling of farrowings to control the flow of animals to the various capital-intensive housing facilities became important."

With this new approach to production, the seasonality of farrowings moderated. Currently, many Midwest crop and mid-size hog farms use two sow herd groups and farrow four times a year: in mid-June (after corn planting); late-August (before harvesting corn); mid-December (after harvest and fall plowing); and early March (before planting). With a gestation period of less than 4 months, and weaning ages of less than 6 weeks, sows can produce more than two litters a year.

"Specialized hog production units have moved to even greater numbers of farrowings per year requiring more than two groups of sows, and sometimes up to 12



Pork Consumption Conversion Factor Adjusted

Armed with new statistics from the U.S. Department of Agriculture, nutritionists should be able to do a better job tracking American pork consumption.

Revised figures from USDA now say Americans have been buying less pork over the last 35 years than previous data suggested—even though pork consumption has stayed about the same since the mid-1950's.

The reason, says ERS economist Lawrence Duewer, "is that pork is much leaner, is trimmed more closely, and in many cases is retailed boneless with little or no skin. Thus, consumers are purchasing less pork than has been indicated by USDA's published retail weight statistics."

In other words, the mathematical calculations (or conversion factors) used to determine how much pork people buy at the supermarket or specialty butcher shop haven't totally mirrored changes in the industry.

But that all changed at the start of 1991. After looking at trends in hog production and merchandising—and the impact of such trends at the retail level—Duewer and other ERS economists revised USDA's pork consumption statistics to reflect changes in the amounts of fat, bone, and skin sold at retail from 1955 to 1990.

Duewer and his colleagues did so by creating a new set of mathematical conversion factors to measure the portion of pork carcass purchased by consumers and the boneless equivalent product.

"These conversion factors are applied to carcass weight 'disappearance' to obtain the given measure," says Duewer. "Pork production, stocks, and foreign trade used in USDA statistics are reported on or converted to a carcass weight basis when used in calculating supply and utilization tables."

Moreover, says Duewer, "these data are sufficiently accurate to derive a carcass weight disappearance that can be used as a starting point for other consumption statistics published by USDA."

The statistical series on per capita pork retail consumption begins, of course, by estimating the quantity of pork purchased by consumers from the carcass weight data. (An advantage of this series is that it is consistent with the average retail pork price series of statistics published by USDA.)

An even more precise measurement of pork consumption, however, turns on the set of consumption statistics entitled the "pork boneless trimmed equivalent" series.

"This series provides a closer estimate of the amount of consumable product," says Duewer. "It is also useful for comparison with other meats, on a boneless equivalent basis, to determine relative consumption levels."

The story of these statistical measurements (which have undergone other changes over the years) points up changes in the pork industry and American eating habits.

"Prior to 1977," says Duewer, "pork production and consumption were calculated and reported on a pork-excluding-lard basis. Lard was once a valuable part of the hog. Lard production and consumption were reported in a separate supply and utilization series of statistics published by USDA. By 1977, lard had become less valuable, hogs were much leaner, and the procedure for determining pork-excluding-lard needed revision."

The new procedure implemented in 1977 was to switch from pork-excluding-lard to carcass weight of production.

"Retail weight consumption was estimated from the carcass weight series adjusted by the USDA series of statistics on lard and pork fat rendered," says Duewer. "Use of carcass weight instead of pork-excluding-lard in 1977 made pork data comparable to other red meats."

Using these new conversion factors, USDA economists revised (in 1977) the statistical series on pork back to 1955.

Pork production is still reported in carcass weight by USDA meat inspectors. However, the retail weight series of statistics had been adjusted only by the fat removed, as measured by lard production.

"With leaner pork, closer trim, and retailing of boneless product with little or no skin, the proportion of carcass weight purchased by consumers is lower than indicated by the previous conversion factor," says Duewer.

Developing new conversion factors began with determining the cutout of an average hog (yield of unprocessed cuts) and how individual cuts are merchandised.

"To determine the cutout," Duewer says, "an average hog was first divided into yields of the various fresh wholesale products from the total live weight. The average carcass yield was estimated at 73.5 percent of liveweight."

Then cutting procedures (bone-in versus boneless) and processed proportions were used to obtain the processing and subcut percentages. The results were converted to percentages of the carcass or retail weight.

"Calculations of the product yield, or processing coefficients, are quite complicated," says Duewer. "Picnics will illustrate the complexity of the calculations. About 90 percent of the picnics are deboned and 10 percent are sold bone-in."

He goes on to say that all of the deboned picnics are assumed to be sold fresh and yield 75 percent boneless picnic meat (cushion in). The other 25 percent is bone and skin. One-half of the picnics sold bone-in are smoked. Of the smoked bone-in picnics, 90 percent are product, adjusted for trimming and facing, plus the water added in processing. In contrast, the bone-in fresh picnics are 80 percent product after trimming and facing.

"Totaling all forms of picnics merchandised," says Duewer, "76 percent of the original picnic weight is sold to consumers. This percent is the processing coefficient for picnics in our calculations."

The next step was the yield determination of all cuts and subcuts per 100 pounds of carcass weight. The 77.6 pounds of product converts to 0.776 pounds of retail product per pound of carcass and was the conversion factor used to change the 1989 carcass weight product to retail weight product.

"These conversion factors will be used for 1990 and re-evaluated in the future as necessary to reflect changes within the pork sector," says Duewer. "In order to make the series consistent and useful for comparison purposes, we went back and created conversion factors for past years that would give us the same kind of information as the current year numbers. We found a cutout that represented the 1955 hog merchandising practices and then it was a matter of moving from 1955 to 1989."

The new numbers for the intervening years reflect the removal of bone and skin (in addition to the fat) and are changed gradually from 1955 to 1989. They include the assumption that retailers began trimming pork more closely after 1985.

"What we actually eat has stayed about the same, in the range of 47 to 51 pounds per capita boneless equivalent consumption each year, since 1955," says Duewer, "even though the retail weight purchased fell 11 pounds for 1990 from the old numbers."

groups," says Spinelli. "In these systems, farrowing occurs almost on a continuous basis and farrowing house capacity becomes the most severe constraint to increasing pig production."

Because 3 to 4 weeks are required to farrow and wean a group of pigs, farrowing house facilities effectively hold the number of groups of sows to six to eight per farrowing facility. In the early 1980's, more than 50 percent of the nation's hogs were raised in partial or full confinement operations.

"The main differences between the larger farms which use labor-saving equipment, housing, and waste-disposal facilities and the smaller hog operations, are not just the substitution of capital for labor," says Spinelli. "Substantial differences include feed conversion efficiency, growth rates in hogs, and litter size. Large operations also are able to take advantage of newer production techniques, and contract marketing arrangements with processors."

And how much are these advantages worth?

"Current estimates place the larger scale operation at a $4 to $8 or greater per hundredweight advantage in cost of production over smaller scale producers," Spinelli says.□

[Based primarily on information provided by economists Felix Spinelli and Lawrence Duewer of the Commodity Economics Division, Economic Research Service.]

ERS Celebrates *30th* Birthday

USDA's Economic Research Service marks its 30th birthday on April 3. It was established in 1961 to centralize economic research and analysis in the Department. Actually, the roots go back 150 years to the congressional mandate for the collection of agricultural statistics.

The mission of ERS is this: "To provide economic and other social science information and analysis for improving the performance of agriculture and rural America."

"We are not policymakers," says John E. Lee, Jr., ERS administrator. "Our job is to provide analysis and information needed by agricultural decisionmakers at all levels. By providing timely, relevant, competent, and unbiased information we hope to serve a constituency that bridges parties, institutions, ideologies and that thus ultimately serves the common good of the larger society."

The agency provides 'timely, relevant and unbiased information.'

"New methods of economic research are useful if, and only if, they help us solve real problems." — Frederick V. Waugh, 1898–1974, a leading USDA economist for several decades.

ERS helps such policymakers and decisionmakers as members of Congress, White House officials, other agencies of Federal, state, and local governments, consumers, teachers, trade associations, rural leaders, extension workers, and farm leaders.

ERS analyzes market conditions, forecasts major agricultural trends, researches and analyzes policy alternatives, responds to information requests, and produces data and indicators of the health of the agricultural economy.

Information is provided in the form of monographs and journal articles as well as more than 80 regularly published situation and outlook reports on various commodities, trade, resource, and policy issues. Besides *Farmline*, a "popular publication" written in a nontechnical manner, ERS publishes such periodicals as *Agricultural Outlook, Rural Development Perspectives, Food Review*, and *Rural Conditions and Trends*. ERS also produces databases, videotape features, and radio and TV news material.

"We are still primarily wholesalers of information," Lee says. "The retailing is done by the private media, Extension Service, agribusiness, and others. The number of copies of a publication that we distribute directly is just the tip of the iceberg compared to the total circulation of the information by others."

One of the most important examples of ERS progress in the last 30 years, according to Lee, is not a product as such but the building of a capacity and process to deliver high-quality staff analysis to policymakers on a timely basis.

John E. Lee, Jr., ERS Administrator since 1981.

Lee cites such landmark ERS projects as:

* A study of the benefits and costs of soil conservation programs, which contributed to various Federal reforms.
* Studies that led to the development of a classification system for rural counties.
* A study of supermarket prices that will provide a benchmark for food market studies and regulations in the future.
* Development of a database and studies that measured farm financial conditions in the 1980's.

In addition, improving global agricultural markets has been a major emphasis for ERS. "The research and analysis we contributed during the Uruguay Round of the GATT trade negotiations was the largest project ever undertaken in the agency," Lee notes. ERS is now assessing the consequences of a range of trade policies of various countries, from protectionist to free trade zones, Lee says. In the years ahead, studies will include Eastern Europe, the European Community of 1992, and U.S. Mexico trade.

In the domestic market, ERS is now studying forces and concerns once considered external to agriculture. These include the environment, food safety, and societal impacts of technology. In addition, there is growing interest in the status and well-being of rural areas, where 27.2 percent of Americans live.

"The years ahead will mean hard work, unprecedented opportunities, and exciting times," Lee says. "The next 10 years will be the best time to be in ERS. More people in Congress, the White House, USDA, OMB (the Office of Management and the Budget) and in the general public want more and better answers to critical emerging issues, such as nontraditional challenges including food safety. ERS intends to provide that and more."

ERS Building, Washington, DC

"The Economic Research Service is, in a real sense, the staff agency to the nation, for agriculture and related subjects." — Willard W. Cochane, USDA Director of Agricultural Economics, 1961–64.

Small Savings Add Up For Beef Packers

Saving a dollar or two per head in the slaughter and processing of beef may not seem like much—but it can quickly add up for plants that handle more than a million head a year.

Even smaller operations can find that seemingly small savings from better management can accumulate and lead to profit-making margins.

That's the picture that emerges from an analysis of beef packing and processing plants, which shows where some of those potential savings may be found.

Recently completed by economists Lawrence Duewer and Kenneth Nelson of USDA's Economic Research Service, the analysis takes on greater relevance in view of the growing concentration in the beef packing industry.

Certainly, says Duewer, this change has been occurring over a number of years. But it's culminated in an industry that looks far different from the one that existed just a decade or two ago.

"The average size of packing plants has increased and more plants now cut up beef carcasses and put them in boxes for shipment, instead of simply slaughtering cattle and selling carcasses," says Duewer. "During 1987, 84 percent of slaughtered fed cattle, from plants reporting to USDA's Packers and Stockyards Administration, left the slaughtering plant as boxed beef, compared with 44 percent in 1979."

These trends follow in the wake of an equally significant change in the structure of the industry.

"Over the past 25 years the beef packing industry has moved to the main cattle feeding areas with the total number of packing plants decreasing," says Nelson.

Cost Factors

Nelson points out that this movement has occurred partly in response to cost considerations.

Moreover, he adds, "packing firms, other firms in the industry, cattle producers, and beef consumers are all concerned about costs in the beef packing industry. Related questions involve economies of size in beef packing, costs of excess capacity, and the relative importance of various components of costs."

Packing plants have moved to the cattle feeding areas.

Using a computer-generated model, Nelson and fellow economist Duewer have attempted to answer some of these questions.

"The results indicate significant economies of size, lower costs of using two shifts, and cost advantages when the same plant cuts up and boxes, as well as slaughters, beef," says Duewer. "Furthermore, the computer program allows for a detailed analysis of costs and can be adjusted to specific situations."

The value of such a detailed look at the industry lies in the complexity of beef packing operations.

There are 20 major steps or stages used in the meat packing/processing operation, from procurement of cattle and storage to waste treatment and sanitation.

In order to determine the costs involved in each of these steps, Duewer and Nelson devised 10 major "accounts" (with as many as 10 additional items under each account).

Under the account of investment (equipment), for instance, Duewer and Nelson prepared cost estimates of six separate items for their computer model: total cost, depreciation, interest (long-term), tax (personal property), insurance (casualty), and repair/maintenance.

The other major accounts—in addition to investment (equipment)—are investment (land), investment (facilities), wages and salaries, supplies and containers, inventory, raw materials (livestock and meat), utilities, revenues, and miscellaneous (including grading services and business licenses.)

While any size packing plant could have been simulated using the computer model, six data sets were constructed," says Duewer. "The plant capacities are 10, 47, 75, 120, 210, and 300 head per hour. None of these data sets represent a specific plant, but all are representative of simulated plants. Costs of actual plants may vary from these estimates."

A Difficult Task

Developing the "simulated plant" in each of the six sizes wasn't easy, Duewer says.

"Getting sufficient data to allow the model to function and achieve the objectives of this study involved an extensive review of available research, visits to packing plants and interviews with plant managers, contacts with equipment firms and contractors, and use of equipment catalogs and other sources," says Duewer. Studies completed several years ago by James Cothern, formerly of the University of California at Davis, were particularly helpful.

At each step of this process, Duewer and Nelson had to answer many questions.

"Before even a seemingly hard fact like the price of a certain company's hidepuller could be used," Duewer says, "assumptions had to be made concerning how many head per hour it would handle and at what line speed another model or another company's hidepuller is more appropriate. Also, is the price at the manufacturing plant, or delivered, is it installed, or in a box so that it must be assembled and put in place?"

Other questions quickly followed for just this item: How is the hidepuller to be paid for or financed? How many years is it expected to function? What is the amount of maintenance and repair expected? How much electricity or other form of energy is needed to run it? How many employees—and at what skill level—are needed to run the hidepuller?

In fact, Duewer and Nelson had to address these kinds of questions for nearly 100 pieces of equipment—ranging from conveyor drives to carcass saws—commonly used in beef packing plants.

Equally difficult was determining average labor costs for the six sizes of plants.

"Labor requirements on the 'kill floor' are quite specialized," says Nelson. "Workers are paid according to how difficult their job is and how much skill or training is required to do it."

Furthermore, he says, "the number of workers varies by line speed and by equipment used."

In their computer model, Nelson and Duewer included detailed information on the specified number of workers needed to perform each job function, the job bracket (or wage level) of those workers, and how many were needed if a second shift is operated.

They took into account the fact that plants can be either slaughter-only, or those in which cattle are slaughtered, cut into smaller pieces, and then boxed before shipping.

Their specific findings show that, as in other areas of agriculture and manufacturing, economies of size exist in beef packing.

"The larger plants need fewer workers per head slaughtered," says Duewer. "They have lower costs on a per head basis and with lower costs they are able to gain greater returns."

Adding another shift also provides significant economies of size.

"This is mainly due to the spreading out of fixed costs," says Duewer. "Fixed costs include such items as interest and depreciation, and variable costs are such things as wages and supplies. We would probably find that operating plants are covering their variable costs. Economic logic says that plants will operate as long as all variable and some fixed costs are covered."

The researchers also found that, more and more, slaughter-only plants are adding processing to their operations in order to stay in business.

"The industry has become so competitive—the profit margin industrywide is considered to average only about 1 percent of sales—that many slaughter plants have shut down and still others may close," says Duewer.

In general, smaller plants have higher operating costs than larger ones. High-cost plants—even those that process as well as slaughter—also appear to be squeezed by the highly competitive and highly concentrated nature of today's beef packing industry.

Although Duewer isn't claiming the computer model—which can be adapted to a plant's specific situation—as a cure-all for any economic problems a plant might have, he is hopeful it will prove useful. By comparing their costs with those of a "simulated" plant handling the same number of head per hour, managers of a plant can quickly pinpoint areas of their operation for examination.

One example of how greater savings can be found is to look at line speed (the rate at which carcasses move by as workers cut, trim, and perform other tasks on them). Such an examination might show that the plant is handling fewer head per hour (with the same number of workers) than the "simulated" plant in the computer model.

"A small operator might use this to cut costs," says Duewer. "If the plant is moving 30 head an hour instead of 40 with the same number of men as the simulated plant in our model, it might be possible to speed up the line."

He notes that smaller plants are already doing other things to compete more effectively with their corporate counterparts.

"Some plants have created market niches," Duewer says, "specializing in 'natural' beef raised without the use of antibiotics or other chemical additives."

By packing a premium product that brings a higher price, higher-cost plants can become, or remain, profitable operations. That's particularly true given the difficulty large plants have in handling specialty or niche items.

"Large producers have to be more concerned about volume than they are about meeting the needs of specialty markets," Duewer says. "It's also difficult for a large packing plant to acquire adequate numbers of cattle raised on a special diet or in a particular way."

Another area of marketing that smaller plants should exploit is their comparative advantage in transportation.

"There are so few cattle handled by beef packing operations in many States that firms there can capitalize on their closeness to nearby markets," Duewer says. "Even if they must charge a higher price than a distant large packer, it still could be lower than the large packer's price when transportation costs are included." □

[Based primarily on information provided by economists Lawrence Duewer and Kenneth Nelson of the Commodity Economics Division, Economic Research Service.]

Rural Lenders Now on A More Secure Footing

How are rural lenders faring compared with their urban counterparts?

Agricultural economists Clifford Rossi and Douglas Duncan of USDA's Economic Research Service recently looked for the answer to this question.

In the mid-1980's, the economists explain, the difficulties of rural financial institutions were more pronounced than those of larger urban banks. However, as the farm financial crisis subsided later in the decade, rural lenders gained a more secure footing.

As in urban areas, there are three main types of private lending institutions in rural America: commercial banks, savings and loans (also known as S&L's or thrifts), and credit unions. With 70 percent of the rural deposit market, commercial banks dominate the rural finance sector. About 54 percent of rural commercial banks specialize in agricultural lending.

"In general," Duncan and Rossi note, "rural lenders have ample credit to extend—both to farmers and other rural borrowers." But they also observe that today's credit standards are tighter than in the early and mid-1980's, and caution that bearish commodity prices and the recession are curbing credit demand.

Agricultural banks (those with above-average concentrations of farm loans) are doing well. These banks have boosted their capital (as a percent of assets) until it is the highest of any of the rural and urban lender groups. Nevertheless, of the 46 rural bank failures in 1990, 22 were agricultural banks.

"Their high capitalization rates protect agricultural banks from unexpected losses, but they also keep the returns on equity slightly below those of other rural banks," Duncan and Rossi observe. "However, their profitability rates are much higher than they were in the mid-1980's."

They note that while the number of nonperforming loans (those more than 90 days past due or not expected to be repaid) held by farm banks is far lower than at mid-decade, it remains high by historical standards. These banks currently hold $1.5 billion in overdue loans, out of a portfolio of $76.3 billion. They hold $8.8 billion in loans secured by farm real estate and $18.3 billion in farm production loans.

Credit standards have been tightened.

"Other rural banks (nonfarm banks) are doing almost as well as agricultural banks, and are probably better diversified," the economists report. "Although their capitalization rates are lower than those of farm banks, so is their proportion of nonperforming loans—the lowest, in fact, of any rural lending group." Twenty-four nonfarm banks failed in 1990.

Rural nonfarm banks also show strong profitability, evidenced by the highest return on equity of any of the lender groups. Indeed, Rossi and Duncan point out that most performance measures (such as average assets and capital as a percentage of assets) indicate that nonfarm banks have improved their financial positions.

The economists explain that the same problems faced by the thrift industry as a whole have affected the rural S&L's. These institutions are losing money, albeit at a much slower rate than urban thrifts. Forty rural S&L's failed in 1989, down from 68 in 1988. Ninety-three urban S&L's failed in 1989 and 153 the previous year. In 1988 and 1989, about 10 percent of all rural S&L's failed.

Rossi and Duncan anticipate that serious difficulties will continue to plague S&L's in the foreseeable future. They will be particularly hard hit by the stiff new capitalization standards enforced by the Office of Thrift Supervision (OTS) and the decline in performance in real estate loans (mostly commercial).

Capitalization rates for both rural and urban S&L's were just over 2 percent in 1989, well under the new 3-percent standard. In addition, their earnings are negative, and liquidity remains a problem.

Credit unions (both urban and rural) are doing better than S&L's and most banks. "They have typically extended loans to their members to purchase personal items, and have largely avoided the riskier investments that got S&L's into trouble in the 1980's," the economists explain. Their earnings are high, their liquidity is also high, and their proportion of nonperforming loans is low. However, credit unions don't account for a significant share of rural lending.

The Farm Credit System (FCS) is recovering, due to increased farm income and the Federal rescue in 1987. This system is made up of cooperatively owned institutions that finance farm mortgages and operating loans. The FCS does not take deposits—it sells securities out of New York to raise the cash it lends.

"In the first 6 months of 1990, earnings and loan volume were up slightly from a year earlier," Duncan and Rossi report. "Earnings were lower in the third quarter from a year earlier, but this decline reflects shrink-

ing reversals of loan loss provisions. Operating income rose."

Duncan explains "shrinking reversals of loan loss provisions" in the following way: Because the FCS had anticipated higher loan losses than actually occurred, it set aside greater provisions than later proved to be necessary. The FCS consequently reduced the size of the provisions by recognizing the excess as income. As the provisions became commensurate with actual losses, there was no longer any excess to transfer back to current income, thus "lowering" reported FCS income.

A New Law, and Uncertainty

Passed in the wake of the S&L crisis, the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) imposes new, more stringent capital standards and restricts S&L lending activities. It also authorizes higher deposit insurance premiums for both banks and thrifts.

"In addition to the new regulations, the recession will further compound the problems of many rural lenders," Rossi and Duncan explain. "Uncertainty about the nation's economy, coupled with recent oil price shocks that have cut into business profits, have effectively reduced credit demand."

Moreover, the greater number of loan defaults that usually accompanies a recession would further decrease bank and S&L earnings. Shaky real estate markets throughout much of the country could exacerbate these losses.

Slipping commodity prices and scheduled cuts in agricultural subsidies under the 1990 farm bill could add to the problems of agricultural lenders in particular. These factors could reduce farm income, leading to greater loan repayment problems.

But the economists anticipate that most rural banks—both farm and nonfarm—will probably survive the present array of adverse circumstances, thanks to their low loan-to-deposit ratios and reduced numbers of nonperforming loans. As of June 1990, there were only 77 weak agricultural banks out of a total of 4,100, and 73 weak nonfarm rural banks out of 3,100. Weak banks are defined as those with capital (minus nonperforming loans) equaling less than 3 percent of assets.

According to mid-1990 data, real estate secures 41 percent of all loans at farm banks and 51 percent at other rural banks. About 1.9 percent of the real estate loans at farm banks were nonperforming, compared with 1.5 percent at other rural banks. "Although the proportion of troubled loans

The Farm Credit System Rescue

The Agricultural Credit Act of 1987 provided up to $4 billion in assistance to FCS institutions through the sale of 15-year uncollateralized bonds guaranteed by the U.S. Treasury. The interest payments on these securities are to be paid entirely by the Treasury for the first 5 years, by the Treasury and FCS for the second 5 years, and solely by the FCS in the last 5 years.

"Most people think of the $4 billion line of credit at the Treasury as the bailout," observes ERS economist Doug Duncan. "But actually the subsidy derives from the fact that the credit line is funded through Treasury bonds, which carry 'below market' interest rates that are not available to the FCS."

Institutions may request this financial aid if the value of borrower stock is below par, and must request it if the value of the stock is 25 percent below par. (Borrower stock is below par when the institution doesn't have enough capital to redeem it at its face value.) Four Federal land banks requested such aid in 1988.

The Agricultural Credit Act also established the FCS Insurance Corporation and Farm Credit Insurance Fund to ensure timely repayment of the principal and interest on notes, bonds, and other obligations of FCS institutions.

Farmers' Credit Needs Vary Greatly

What sort of lending situations are individual farmers facing? How are they managing their credit needs? *Farmline* asked several producers.

"The days when a farmer could borrow on his name alone are over," states **Monnie Miller**, who has a cow-calf operation near Perkins, Oklahoma. "Now when you want a loan, you have to have your financial statement and budget in order. You have to show that you'll get a return on the money." But he also points out that farmers who have planned well and can show a reasonable chance of making a return can still get loans.

When Miller began running his family's ranch some years ago, he sold a lot of cattle to cover some debts, and had money left over. He now grazes 125 cross-breed Herefords on 1,000 acres of pasture (400 owned, 600 leased). Miller hasn't borrowed money in 5 years, and has no plans to do so unless he expands. "The Financial Institutions Reform, Recovery, and Enforcement Act and tougher regulation will probably protect banks, S&L's, and ultimately the customers because it will prohibit lenders from making loans that perhaps shouldn't be made," Miller remarks.

The **Simmons** family owns and operates a beef cow-calf and feed operation in Laurens County, South Carolina. **John** manages the cattle farming while his son **Mart** takes care of the feed operation. Their 180 Simmenthal brood cows graze on about 500 acres of bermuda hay and winter grasses.

Over the last several years, the Simmonses have borrowed only enough money to buy grain, in the form of small, short-term loans. "When we do borrow," Mart Simmons explains, "we use our local bank, because it's easier to deal with, and we've established a good relationship with it over the years." (Back in the 1970's, they did borrow from the Federal Land Bank, and from the Small Business Administration.)

"We've been concentrating on expanding our beef production and buying more grazing pasture," Simmons states. "We haven't been growing as much wheat and soybeans because the market for grains hasn't been good, exports are down, and it seems unlikely that prices will improve any time soon."

Simmons also notes that although getting credit presents no problem, "it has to be earned." He expects the new law probably won't affect Laurens County farmers at all—most of them are part-time operators running small-acreage farms with 10 to 25 cattle, and have limited credit needs.

"In nearby Greenville, real estate is hot, and industry is growing," Simmons says, "but the slump has hit smaller areas harder. There's just not the demand for farmland there once was."

Charlie Rohde farms 3,200 acres near Langdon, North Dakota, where he raises durum and hard red spring wheat, barley, sunflowers, flax, and rapeseed. Rohde occasionally borrows money to purchase more farmland, and to cover operating expenses.

Like the Simmonses, Rohde usually deals with his local bank. "I have no trouble borrowing money because I

in June 1990 had declined from late 1989, real estate could pose a problem for these banks if the nation's economy continues to slow," the economists point out.

The future of rural S&L's is less secure. Out of the 900 S&L's in rural areas, Rossi notes that 121 are technically insolvent and cannot meet FIRREA's new capital standards. In addition, about 100 solvent S&L's are believed to have serious problems.

Rossi and Duncan estimate that although 80 percent of all solvent rural S&L's could pass the new capital standards, 17 percent could not meet FIRREA's risk-based stan-

Charlie Rohde

have good credit, and have never gotten behind in my payments," he explains. Farmers in his area rely mostly on their two local banks, the Production Credit Association (a part of the FCS), and the Farmers Home Administration (FmHA) for their credit needs.

Rohde goes to the same bank because he has established a good working relationship with it. But, like Monnie Miller, he stresses that farmers trying to get credit must have their financial statements in good shape. "They have to demonstrate to the lender that they can repay the loan," he says. "Lenders in this area are being more cautious, and some farmers may have trouble getting loans." Rohde sees the new law as necessary to prevent future irresponsible lending.

John King and his brother **James** grow tree fruit in Antrim County, Michigan. Together they own about 140 acres on which they produce red tart cherries, apples, sweet cherries, peaches, apricots, and nectarines. Last year, they leased another 24 acres of cherries and 13 in apples. This year, they will lease at least 110 acres in cherries.

"We've borrowed a lot of money recently," John King explains. "When we began farming about 11 years ago, the FmHA lent us 100 percent of the money to buy the farm. We've also borrowed for machinery, buildings, and operating expenses." Although King has relied primarily on the FmHA for credit, he's also obtained it from the Production Credit Association and his local bank.

The Kings lost money last year when severe spring weather ravaged their sweet cherry, tart cherry, and apple harvests. To meet operating expenses, they had gotten a loan from their local bank which was guaranteed by FmHA.

Their losses make them eligible for low-interest disaster loans. "Although this helps us to keep operating, what we really need are Government grants," King observes.

King explains that they'll need an emergency loan from FmHA to operate this year. "We hope to pay back the loan guaranteed by FmHA, and eventually rely on the local bank for our credit needs," King states.

But in the meantime, the Kings are supplementing their income in a variety of ways. John's wife **Betsy** runs a fruit stand, and John and James custom-harvest cherries for other growers. They run a cider press from which they supply 30 commercial accounts, they bag and box apples which they sell to 30 grocery stores. "We're looking forward to a good year," King concludes.

dard, which ties the capital requirements of an institution to the riskiness of its investments. Indeed, most of these firms will find it hard to achieve the necessary degree of capitalization, and many are selling off assets to improve their capital ratios.

"In effect, the new Federal standards will mean more loan sales, failures, and mergers," the economists state. "And the real estate slump will really hurt rural S&L's because real estate loans comprise 90 percent of their lending."

Rural credit unions are better insulated from the troubles of rural S&L's and some banks, but anxiety prompted by the recession is dampening consumer demand for credit union lending as well. Credit union customers may have difficulty repaying loans, or might even default, Rossi and Duncan observe. Consequently, credit union earnings and capital may decline.□

[Based on information provided primarily by economists Douglas Duncan and Clifford Rossi of the Agriculture and Rural Economy Division, Economic Research Service.]

More Producers Could Benefit From Chemigation

Chemigation—applying chemicals to soils and plants through irrigation water—can cut costs for many farmers and reduce the possibility of groundwater contamination, according to economist Noel Gollehon of USDA's Economic Research Service.

Fertilizer is the most commonly applied input, but chemigation is also useful for herbicides, insecticides, fungicides, and nematicides. Few mechanical changes are required to adapt an irrigation system. Most types of systems are suitable—including sprinkler, surface, drip, or trickle.

What is needed? A precision pump to inject the chemicals into the irrigation water, a storage unit for the chemicals, connecting pipes, and safety equipment. Pumps can be calibrated to inject different amounts of chemicals, such as 1 pint per acre of insecticide or 30 gallons per acre of fertilizer.

Chemigation offers the opportunity for reducing the potential of groundwater contamination by reducing the quantity of active chemical ingredients used in the production processes for all producers, in total. For example, it gives producers greater choice in the timing of pesticide and fertilizer applications that is unavailable under most traditional systems that require scheduling chemical applications in advance. In other words, with chemigation the producer may postpone or even forego chemical applications.

Chemigation is cost-effective when the irrigation system is already in place and chemicals need to be applied several times in a season, according to Gollehon. Use of an irrigation system for chemigation alone is not likely to justify its purchase and installation. However, using it for both processes may lower the cost of each use. Also, chemigation use may justify a more efficient irrigation system that permits greater flexibility in applying both chemicals and irrigation water.

The cost of chemigation equipment—injection pump, chemical storage tanks, and pipes—can range from $2,000 to $8,000 for a center-pivot system covering up to several hundred acres, Gollehon says. Safety equipment to protect against contamination of a water source usually costs about $l,000 per well.

The most common and flexible irrigation system used for chemigation is the center-pivot sprinkler. Sprinkler systems permit foliar as well as ground chemigation, unlike surface and drip or trickle systems.

An effective chemical application system requires both proper calibration of the chemical injections and a well-maintained, efficient irrigation system. The Cooperative Extension Service may provide help with calibration.

Safety equipment is not foolproof, Gollehon says, so water contamination continues to be a concern. Water containing chemicals can accidentally backflow or be injected into a pipe running to the water source. Public concern has led to laws, standards, and regulations at State and Federal levels.

The American Society of Agricultural Engineers (ASAE) has recommended safety features for chemigation systems. Chemigation is regulated by several states with diverse irrigated conditions, including Colorado, Nebraska, Florida, and Minnesota. Several others are drafting legislation. The Environmental Protection Agency (EPA), under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), requires manufacturers to verify on the labels of various products their suitability for chemigation. These products include pesticides, insecticides, herbicides, nematicides, fungicides, soil fumigants, and plant growth regulators.

The standards of the States, the ASAE, and the EPA are not consistent or comprehensive, Gollehon says. The equipment requirements established by EPA are more stringent than ASAE recommendations and many State requirements. Many States are rewriting their laws to be consistent with EPA. In addition, EPA is accepting some alternative equipment configurations as meeting the standards.

Chemigation is used on all major crops and in all production areas, according to the 1988 *Census of Agriculture*. The greatest use of fertilizer chemigation was on potatoes, followed by orchards, rice, corn, and sugar beets. Pesticides were applied through chemigation to all 21 crops surveyed in the Census. Such applications were made to almost 25 percent of the potato acreage and 17 percent of the rice.

Almost 224,000 U.S. farms used irrigation in 1988. This number represents the potential user group for chemigation.

In 1988, fertilizer was applied through irrigation systems on about 25 percent of the 43,000 irrigated corn farms. If all irrigated corn acreage had been chemigated, the chemigated acreage would have accounted for only 14 percent of U.S. corn acreage. However, most U.S. acreage in orchards, vegetables, rice, and potatoes is irrigated.

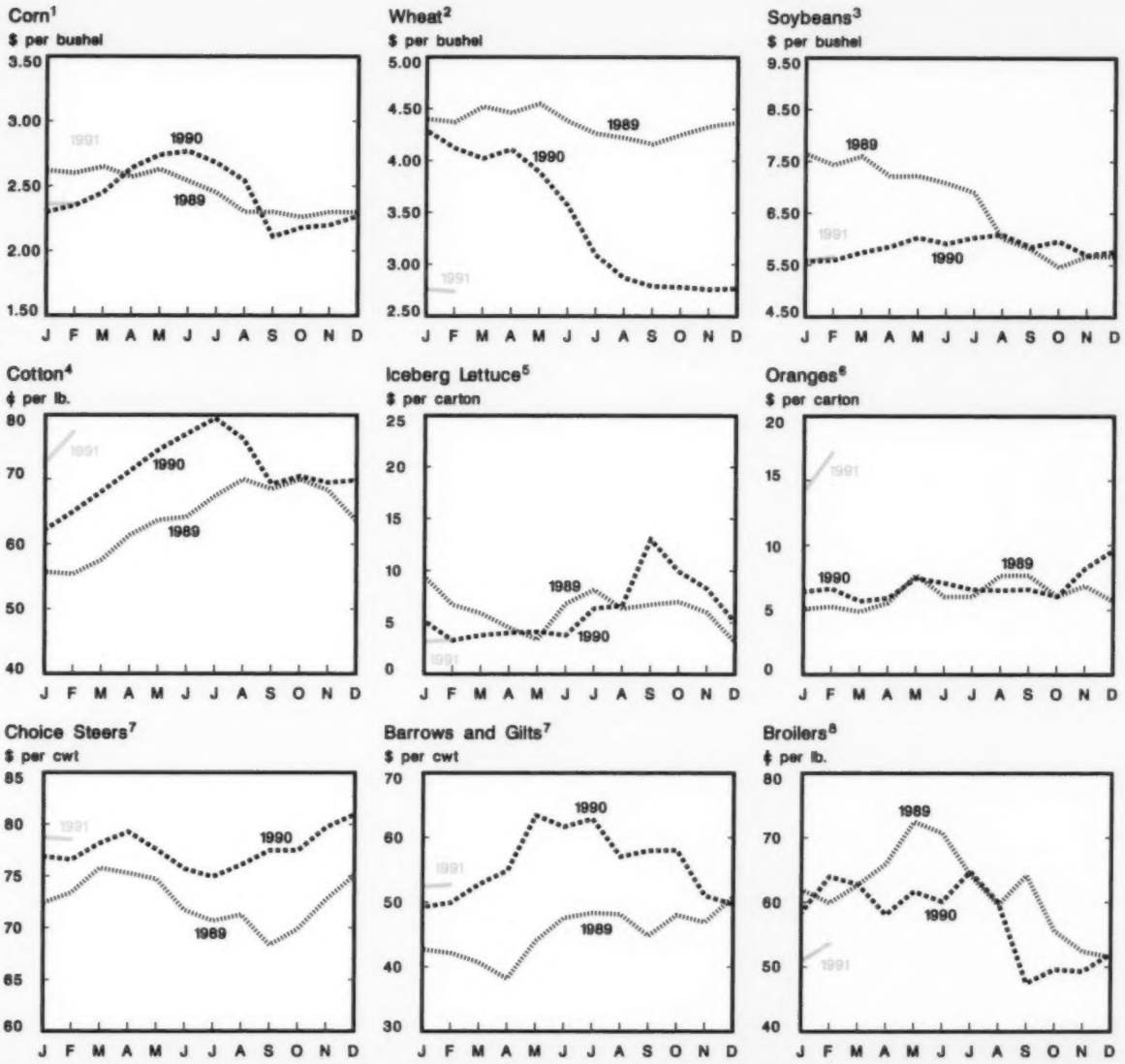
About 47 percent of U.S. farms producing irrigated Irish potatoes (some 2,000 growers) apply fertilizer through chemigation. About 70 percent of all potatoes are irrigated, meaning that some 35 percent of total potato acreage is now fertilized through chemigation.

Chemigation is expected to increase, for two main reasons. First, it is cost effective, making use of existing irrigation systems. Second, it is best suited for sprinkler or drip/trickle irrigation and the share of land devoted to specialty and commercial crops, which use this method of irrigation, is increasing.

— Carol Lee Morgan

Monthly Price Monitor

USDA's February 1991 inflation-adjusted index of farm prices decreased 0.7% from January and was 4.6% below its year-earlier level. Corn remained at $2.37 per bushel, while soybeans gained 7¢ to $5.68. Wheat, at $2.75 per bushel, fell 2¢ to its lowest level since August 1987. Cotton gained almost 5¢ to 77.7¢ per pound, its highest average in 6 months. Iceberg lettuce gained 18¢ to $3.43 per carton. Oranges, because of the December freeze in California, were at a high of $17.34 per carton; the February 1990 average was $6.64. In the meat animals area, choice steers fell 20¢ per cwt to $78.63, while barrows and gilts gained almost 30¢ to $52.92 per cwt. Broilers increased 2.4¢ to 53.9¢ per pound.



[1]No. 2 yellow, Central Illinois. [2]No. 1 HRW, Kansas City. [3]No. 1 yellow, Central Illinois. [4]SLM 1-1/16", spot market price. [5]Standard carton 24's, California-Arizona. [6]Central California, Standard carton. [7]Omaha. [8]Wholesale, New York. All prices shown are monthly averages.

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